

to-day is, I am assured, but the feeblest of utterances as compared with the heartfelt gratitude and wondering praise that will be the reward of this great thinker in those future times when the very lowliest in the land shall have full grasp of the meaning of his teaching," &c.

On the whole, the "Student's Darwin" deserves to be successful in its object of popularising Mr. Darwin's work. The great bar to its usefulness will be its needlessly aggressive tone towards religion, which is sure greatly to lessen a circulation which it might otherwise have had.

GEORGE J. ROMANES

### LETTERS TO THE EDITOR

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.]

[The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to ensure the appearance even of communications containing interesting and novel facts.]

#### Tebbutt's Comet—Origination of its Proper Light

WHILE there seems now no doubt that the honour of being the discoverer of the great comet of 1881 belongs without question to that life-long and most persevering observer, as well as successful computer, of comets, in Australia, Mr. John Tebbutt, three communications which chance to have arrived here this morning from different countries contain most diverse ideas of the nature of that portion of the comet's light which universal spectroscopic observation proves is inherent to the comet itself, indicating the existence there of carburetted gas of some kind, and is quite distinct from the concomitant weak reflection of solar light.

1. In Abbé and Chanoine Moigno's *Les Mondes* for August 25, that excellent physicist in Paris, M. Jamin, is represented as stating that the comet's carburetted gas could be rendered "properly" luminous only in two modes, viz., either by combustion or electric discharges. "If by combustion," says he, "how did it first take fire? what keeps up the fire perpetually? and how are the materials of the comet kept, in such a fire, from becoming red-hot, and then giving out quite a different spectrum to any that has yet been observed?" Wherefore he concludes that the cause of the "proper" light of the comet is the illumination of its constituent molecules by electric discharge, as in the gas-vacuum tubes of our laboratories.

2. But next comes a pamphlet from that accomplished spectroscopist and astronomer, Prof. C. A. Young of Princeton, New Jersey, U.S., setting forth that the bands of carburetted gas seen in the comet's spectrum do most admirably and exactly agree with the combustion-bands of coal-gas and air, as seen in a Bunsen-burner or a blowpipe flame, or in the blue base of all carbo-hydrogen flames known; while they do, on the contrary, most eminently, markedly, and distinctly disagree from the bands of the spectra of the same gases as seen in gas vacuum-tubes when illumined by electric discharge. And this conclusion of the eminent American physicist is confirmed by a pamphlet just received from M. Fiévez, the spectroscopic observer of the re-organised Royal Observatory of Brussels; as was also announced at the very time of the comet's appearance by the present most acutely observing Astronomer-Royal at Greenwich.

3. What then! Is M. Jamin's theory of the comet's proper light being entirely due to electrical illumination utterly overthrown, and the celestial phenomenon given over to a process of combustion, the mere mention of the necessary details of which suffices to show it ridiculous and impossible?

4. Not yet, I venture to think. We ought to discriminate in such a case most carefully between electricities of different intensities and different temperatures. Something too of that kind, and even much to the purpose of this cometary case, I had the honour of setting forth to the Royal Society, Edinburgh, last year, in a paper which is now being printed for their *Transactions*. For it was shown therein that, when using an induction-coil capable of giving sparks of such intensity as to be five inches long in the open air, a gas vacuum-tube of olefant gas showed only the carburetted bands which Prof. Young alludes

to as being absolutely *not* the bands which the spectrum of the comet exhibited. But when a smaller coil was employed, and more particularly when its outer helix of long thin wire was replaced by another of short thick wire (specially prepared for the experiment), and the sparks thereby lowered in intensity to such a degree as from 1.3 of an inch, to be capable of only passing through 0.2 inch of air, then, when employed to illuminate the same olefant gas vacuum-tube, besides the bands seen before (but now more faintly), another set of bands appeared, which were exactly those of the combustion of coal-gas and air, of Bunsen burners, blowpipe flames, blue base of all carbo-hydrogen flames, and finally—*teste* Prof. C. A. Young, M. Fiévez, the Astronomer-Royal, W. H. M. Christie, and others—of Tebbutt's great comet of 1881.

5. From this condensation of testimonies I presume that no other conclusion is to be drawn than that the electrical discharges permeating the whole length of a comet's tail must be something exceedingly weak in intensity;—and the gentlemen who employ electrically lit-up gas vacuum-tubes in their laboratories must do their spiriting with them in future much more gently, if they would really arrive at what goes on in cometary existences. The following exception, too, duly mentioned by Prof. Young, to his general rule, seems to tend in the same direction. For he states "that while the evidence as to the identity of the flame and comet spectra is almost overwhelming, the peculiar ill-defined appearance of the cometary bands at the time of the comet's greatest brightness is, however, something which he has not yet succeeded in imitating with the flame spectrum."

6. "Certainly not," we may add to this most honest confession; for as the comet's greater brightness near its perihelion passage could hardly be due to anything else than a temporary increase in the intensity of its illuminating electric currents, that would tend to bring out the tube-set of carburetted bands to interfere with, and spoil the neatness and sharpness of, the so-called flame-bands, and would certainly imply a quality or temperature which does not exist in any known simple flame, but is found in the spark of even the smallest induction coil, unless some special means are taken to damp down its intensity.

I have long wished at this Observatory to try a whole course of electric illuminations, as of the old friction machine, Holtz's machine, modern dynamo-machine, coils in variety, and whatever is capable of giving out electricity in any visible luminous shape; but the state of miserable starvation in which this Royal Observatory, Edinburgh, is kept throughout all its branches by Government, and their continued neglect of the applications of their own "Board of Visitors" to "endeavour to obtain justice to this Observatory"—the very words of the last public remit from the Board-meeting, of which the venerable Duncan McLaren, then M.P. for Edinburgh, was chairman—prevent any important apparatus being purchased, or even obtained on loan, to prosecute the inquiries which the science of the times demands.

PIAZZI SMYTH,

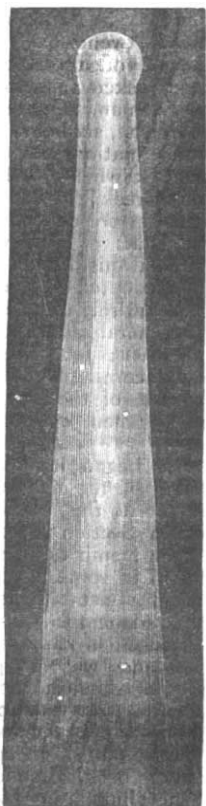
Astronomer-Royal for Scotland

Royal Observatory, Edinburgh, August 29

#### Schaeberle's Comet

SINCE my last remarks I have had an opportunity to examine this fine object with the 6" Cooke equatorial. On Wednesday evening, the 24th, simultaneously with the Great Bear stars, it was easily seen as soon as twilight set in, near the horizon and considerably more to the west than on the 21st. With a comet eyepiece it presented, in spite of its low altitude, a sharp and well-defined figure. The nucleus was stellar-like, with, I thought, a still brighter minute central point. No jets of light proceeded directly from it, but it appeared surrounded by a circular nebulosity of greater extent than the base of the tail, and giving the headed form to the comet frequently seen in old drawings of these objects. The tail was straight, long, and luminous, with a central ray of condensed light which gave it a cylindrical look. When first examined three small stars were involved in the tail without any apparent diminishing of their brightness; while two others below served to define the limit of the tail's visibility in the comet eyepiece. This measured two degrees only, but both it and the nucleus were of a peculiarly fine pale blue tint. I send a drawing of the telescopic appearance of the comet at 8h. 40m. On the nights of the 27th and 28th the comet was again examined at about 8h. 30m. Under a lower power Kellner the appearance was that of a round comet with a central

nucleus and circular coma. The tail was to be seen, but was quite faint, and as before was less at the base than the width of



Sketch of Schaeberle's Comet, August 24, 8h. 40m. in 6" Cooke equatorial.

the coma. Dr. de Konkoly has examined the spectrum of this comet, and found it a faint continuous one, with three tolerably bright lines, at following positions:—

				Estimated brightness.
I.	5601	± 2.5	...	0.4
II.	5161	± 0.9	...	1.0
III.	4753	± 0.6	...	0.8



Schaeberle's Comet, August 28, 8h. 32m.

The appearance of this comet throughout has been peculiarly distinguished from that class in which jets of light streaming

from the nucleus in front fall back to form the tail or a bright margin to it. These, as far as I have seen, have been absent.  
Guildown, August 31

J. RAND CAPRON

#### Comet $\delta$ 1881

M. CH. FIEVEZ, the Astronomer adjoint at the Royal Observatory, Brussels, has been good enough to send me a copy of his note on the analysis of the light of this comet, made with the 15-inch Merz-Cooke equatorial, provisionally installed at the Avenue Cortenberg. The polariscopic observations demonstrate that the polarisation of the nucleus was strong (*très nette et bien accentuée*), while that of the tail was very weak. These observations were made at several days interval, from 11h. till midnight. Sky polarisation was scarcely sensible. The spectroscopic observations proved the spectrum of the comet to consist of four bands of intensity in the following order: green, blue, violet, and yellow, with wave-lengths 5160, 4780, 4200 (about), and 5620. The original appearance of these bands was modified as the comet receded from the sun, their edges towards the red then becoming more and more defined. The nucleus presented a brilliant continuous spectrum, in which however the Fraunhofer lines were not recognised. The conclusions arrived at by M. Fievez were as follows:—That a great part of the light of the comet was inherent to it, while the other part was reflected solar light. That the strong polarisation of the nucleus indicated a marked state of condensation of the matter composing it. That the spectrum differed little from that of other comets. Lastly, that the marked modifications in the brilliancy of the continuous spectrum, and in the appearance of the spectrum bands indicated a progressive diminution in the comet's temperature. The chief interest in the above observations attaches to the feeble polarisation detected in the tail as compared with that found by Prof. A. W. Wright and Mr. Cowper Ranyard, and in the absence of the Fraunhofer lines, which were measured by Dr. N. de Konkoly, and also photographed by Dr. Huggins. Whence, we may ask, arises the divergence of conclusions arrived at by M. Fievez and Prof. Wright respectively, the one considering that the principal part of the comet's light is from itself, the other that it is reflected sunlight, and why were the Fraunhofer lines seen in the one case, and not in the other? The answer lies, I think, not with the instruments employed, but rather in the interesting probability of change in the comet's structure or condition during the time of its examination. A comparison of the many observations recorded during its stay with us may possibly lead to important discoveries in this direction. I am much interested to see that Prof. C. A. Young informs us that the green band was seen by observers at Princeton split up into fine sharp lines coinciding with those seen in the flame spectrum, a result to be expected, but hitherto not attained.

J. RAND CAPRON

Guildown, September 3

THE comet at present visible was examined by me with the spectroscope on the 8½-inch refractor on Saturday evening, August 27. The three principal hydrocarbon bands were plainly visible, the central one being the brightest, and on comparing them with the spectrum of a spirit-lamp flame the coincidence of the least refrangible sides of the bands in the two spectra was sensibly complete. The nucleus gave a narrow continuous spectrum, and I could see no trace of such a spectrum except from that point. I could see no other band in the spectrum except the three above mentioned, but the proximity of the comet to the horizon may have something to do with this.

GEORGE M. SEABROKE

Temple Observatory, Rugby, August 29

#### A Pink Rainbow

I SPENT Sunday, August 21, at Mr. Tennyson's house, Aldworth, near Haslemere. The house stands on an elevated ledge of the Blackdown range, looking over the Weald towards the Brighton Downs, between east and south-east. About sunset the deep red of the south-eastern sky attracted our attention, and while we were looking at it we saw stretching across it a well-marked rainbow, but of a uniform red or pink colour, which Mrs. Tennyson compares, in a note I have just had from her, to a "pink postage-stamp"—not the one now in use, but the last discarded one. This was seen distinctly by Mrs. Tennyson, Mr. Hallam Tennyson, and myself for, I think, more than a minute. Mr. Hallam went to call his father, who was in another room,